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Art. IX.—1. *Letter from the Secretary of the Treasury, transmitting the Information required by a Resolution of the House of Representatives, of May* 11, 1826, *in relation to the Growth and Manufacture of Silk, adapted to the different Parts of the Union.* Washington. Gales & Seaton. 1828. pp. 220.

2. *A Treatise on the Culture of Silk in Germany and especially in Bavaria, or Complete Instruction for the Plantation and the Management of Mulberry Trees, and the Rearing of Silkworms.* By the Counsellor of State de Hazzi, &c. Translated from the German. Washington. Gales & Seaton. 1828. pp. 108.

Mr Miner deserves the gratitude of his country for the resolution moved by him in the House of Representatives, on the twenty-ninth of December 1825, on the subject of the encouragement which the culture of silk merited, and might receive from the national legislature. The report of the committee on agriculture, to whom this proposition was referred, was well adapted to stimulate the zeal of Congress; and, though very short, throws much light upon the subject, and contains sound reflections upon the necessity of cultivating all the national resources of the country. They enforce their arguments, by a statement of facts, which show that the decay of the resources previously derived from the principal branch of rural economy, rendered necessary a sedulous attention to other branches of industry, which may take the place of those on the decline. From 1817 to 1825, inclusive, the exports of bread stuffs fell from twenty millions, three hundred and seventy-four thousand dollars, to five millions, four hundred and seventeen thousand, nine hundred and ninety-seven; whilst the importation of silk goods was increased in the interval from 1821 to 1825, by nearly six millions. The whole amount of silk goods imported within those five years, is estimated at thirty-five millions, one hundred and fifty-six thousand, four hundred and ninety-four; and their export, in the same space of time, was below eight millions. The report of the committee terminated by a resolution, directing the Secretary of the Treasury to cause a well digested manual to be prepared, 'containing the best practical information, that can be collected, on the growth and manufacture of silk, adapted to the different parts of the

Union, containing such facts and observations, in relation to the growth and manufacture of silk in other countries, as may be useful.'

In compliance with this resolution a set of queries was prepared by Mr Rush, which, together with a copy of the resolution of the House of Representatives, were forwarded to the governors of the several states, and to a great number of individuals, enabled by their studies, or pursuits, to furnish exact and useful information upon the subject. The preparation of these queries was a work of great labor, and the manner in which it was executed does infinite credit to Mr Rush. The information, collected from the answers made to these queries, was embodied in a report, submitted in February last by Mr Rush to the House of Representatives, of which six thousand copies were ordered to be printed for distribution. By another resolution, a work in German by Mr de Hazzi (the second named at the head of the present article), and sent by him to Congress, was ordered to be translated into English; and of this work, also, six thousand copies have been printed. Both publications are accompanied by plates and wood cuts. Thus has Congress liberally provided for the collection and wide circulation of a mass of *data* concerning the culture of silk; and it now only remains for the persons already interested in this branch of industry, and for those who wish to share in its profits, zealously to avail themselves of the instruction thus afforded to them.

The Manual annexed to, or rather constituting, the report of the Secretary of the Treasury is made up of a variety of materials. Much has obviously been collected by means of personal inquiries of men practically engaged in the culture and manufacture of silk, and of silk-dyers, in this country. More has been extracted from the best theoretical writers on the subject (some of whom, as, for instance, Count Dandolo, were actively engaged in the breeding of silkworms, and in the rearing of mulberry trees, upon an extensive scale); and from printed accounts of the experiments which had been already made in this country. Not a little has been derived from the official correspondence of several governors, and private individuals, in answer to the queries of the treasury department. Among these last sources we shall particularly mention a letter of Governor Wolcott, not because it is the only one entitled to notice, but because it seems to leave nothing to desire, in regard to perspicuity and fulness of detail.

By means of the abovementioned materials, and the information gleaned from several French and English treatises, we shall present to our readers a sketch of the methods of raising mulberry trees, of rearing the valuable worms which feed upon their leaves, and of the culture of silk in general.

The mulberry tree is mentioned in various passages of Scripture. David was directed by the Lord to come upon the Philistines '*over against the mulberry trees*' in the valley of Rephaim. (2 Samuel v. 23.) Among the writers of classical antiquity, we find the mulberry tree mentioned in Ovid's Metamorphoses, in the story of Pyramus and Thisbe. Pliny the elder repeatedly speaks of the mulberry tree. He mentions the budding, and shooting of the leaf, as the surest indication that the winter, and the frosts, are over. The name of the fruit in Greek is μόϱον and of the tree μοϱέα, and the name of *Morea*, which now belongs to the ancient Peloponnesus, is ascribed to the great quantity of mulberry trees, which are found there. The Greeks were acquainted with this tree, and with the silkworm, from the time of Alexander the Great; and Mr Phillips* is, therefore, in some degree, warranted in doubting the authenticity of the tradition, by which two monks are generally represented as having first brought the silkworm into Europe, in the time of Justinian.

But we must hasten to the period at which the mulberry tree was first introduced in England, the only country, in regard to which, in this respect, we have sufficient information. Before however, we enter on this part of our subject, we beg leave to say a few words on the nature of this tree.

It belongs to the Scabridæ, and is of the class Monœcia, and of the order Tetrandria.

The varieties are,

1. *Morus Alba*, the white mulberry tree, a native of China.

2. *M. Nigra*, the black mulberry tree, which is of the largest size. The fruit is of a dark red color, and furnishes a good wine. It is a native of Persia.

3. *M. Rubra*, the red mulberry tree, a native of Virginia.

A variety peculiar to Japan is called *Papyrifera*, because a kind of paper is made of the bark of it.

This tree, which seems especially destined by nature for the feeding of the silkworms, harbors no other caterpillar, nor breeds any sort of vermin. The acrid bitterness, which belongs to the root, has been found a remedy against worms; and it is probable that the sap is impregnated with it, and gives to the tree the property, which we have just mentioned.

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* *Pomarium Britannicum*, by Henry Phillips. Third edition, London, 1823.

It seldom produces fruit before an advanced age; and this circumstance may have contributed to its neglect; but by grafting this inconvenience is removed. The mulberry tree attains a very great age. It thrives in every kind of soil, and no other tree of equal growth and beauty resists so well the influences of the sea atmosphere.

'Two or three grand specimens of this beautiful tree,' says Mr Phillips, 'standing in the most exposed situation of the north east coast of England, not only defy the enemy, but delight in their situation, throwing out their noble limbs in all directions, and assuming a foliage, rich, full, and tufted to its topmost boughs. One of them is of the greatest magnitude, though some of its vast limbs have been torn from it; but it is still in vigor, and, in point of richness of effect, the oak itself, is scarcely superior. They are abundantly prolific.'

We have, thus far, principally gathered our facts from Mr Phillips's *Pomona*, a work not less entertaining for the general reader, than useful for the practical gardener, or the tasteful land proprietor. We turn now to Mr Rush's report, where we find, in a few pages, an abundance of interesting details, which it would cost much time and labor to collect from other sources.

The red mulberry is considered as the only species indigenous in this country. The northern extremity of Lake Champlain is, according to Michaux, its most northern limit; yet it has also been found in Massachusetts. It abounds in all the states of the Union south and westward; and Dr James found it as far west as the lower part of the river Canadian.*

Doubts have existed in regard to the fitness of the red mulberry leaf for the feeding of silkworms. But experiments made in Louisiana and Missouri afford reasons for believing the fact, at least as weighty as the assertion to the contrary made by a Mr Delongchamp, which relates only to France. Besides, there is obviously a contradiction between his denial of the red mulberry's fitness for the feeding of the worm, and the

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***Annals of the Lyceum*. New York. vol. ii. p. 246.

fact observed by him, that it eats indiscriminately the leaves of both the white and red species.

Judge Bry, of Washita, has sent to the Secretary of the Treasury leaves of a species of the red mulberry, which are described in the *Manual* in the following manner;

'The leaves received, are three-lobed, three-nerved, unequally serrated; base, subcordate, entire; lobes, ovate, oblong, acute, or acuminate; sinuses, broad, with large, interjected, acute teeth; both surfaces rough.

'The leaves are larger than the red species; upper lobes more ovate, with base narrowed; no pubescence beneath; lateral lobes narrower than the middle. Teeth of the sinuses, sometimes entire, sometimes with a few unequal teeth on the side. Upper sinuses broader than the lower.' p. 34.

In a manuscript which lies before us, it is positively stated, that the white mulberry has never been seen in Louisiana; the writer thinks, however, that it would thrive there, the soil and climate being well adapted to its culture.

In Georgia the mulberry seems to grow in all its varieties. Beside the three principal species, there is also the paper or Chinese mulberry. They are found mingled in the native woodlands, and often of large growth. 'Every variety of our soils,' says a writer from Darien,* 'seems to suit the mulberry. They grow well upon the sea-coast, upon our *hammock* lands, and upon the pine lands a little in the interior; and I have seen them growing, and bearing abundantly, on the dikes that surround our alluvial lands, that were in rice.'

But the white mulberry is, on all hands, admitted to be the most appropriate for the rearing of the silkworm. For this species, Europe is indebted to Asia, whence the crusaders imported it. During the invasion of Italy under Charles the Eighth, the French became acquainted, at once, with this tree, and the advantages which are derived from it. The first mulberry tree was planted in France, near Montelimart; and nearly three centuries after (in 1802), the original tree was still in existence. In England it was first planted in the year 1548; Mr Phillips saw at Sion-House the original trees. He found their interior so decayed, that the timber crumbled on being touched; the propped branches were, nevertheless, so well nourished, that the fruit and the foliage were not inferior to those of the youngest trees. Of the plantations formed during the reign of James the First, many venerable remains are still seen in England. The author whom we last quoted, found a black mulberry tree in a garden adjoining Greenwich Park, which is supposed to be one of the oldest in England.

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*MS. letter to Mr Rush. Darien, Georgia, Oct. 14, 1826.

'It throws out,' says Mr Phillips, 'ten large branches so near the earth, that it has the appearance of half a score of large trees rather than of one; and, notwithstanding many of the projecting branches have been sawed off, still it completely covers a circumference of one hundred and fifty feet; and although the elder trees have fixed their abode in some parts of the trunk, and other parts are covered with ivy, yet it continues to give shoots as vigorous as the youngest tree, and produces the finest mulberries in England. It is a regular bearer, and the gardener assured me, that he gathered more than eighty quarts a week, during the season.'

The best soil for the mulberry tree, and especially the white species, is a dry, sandy, or stony one; and the more it leans to these qualities, the more proper it is for this culture. Moist lands, even when the trees grow luxuriantly, render the leaves less nourishing, by containing too much water, which, as will be shown, is one of the substances in the mulberry leaf, but not the most nutritious. In forming plantations, care should be taken to place them in a sunny exposure, and to shelter them against strong winds. Mr de Hazzi advises to place them upon declivities towards the east or south-east, and to screen them by other woods. Dust being hurtful to the trees, places near the high roads are not eligible. In the choice of soils, it may be generally observed, that such as are apt to cover the bark with moss, create what is called the 'disease of the heart' among the trees. Hedge rows must not be formed so close together, as to obstruct the free access of the air. To protect the mulberry against the consequences of night frosts, the same methods which are employed with other trees, as, for instance, straw mats and sprinkling with cold water before sunrise, may be used with safety.

To propagate them, several means are employed, namely, by seed, by roots, by layers, cuttings, and suckers; and to improve a variety, there are also several species of grafts, namely, the pipe-grafting, the budding, the crown-grafting, the grafting upon the branches, and near the roots.

The proper time of sowing depends upon the climate. This, in Bavaria, is towards the end of April. But the land must have been broken up, and dug, in the preceding autumn. On the approach of spring, it must be well stirred. Drills six or eight inches asunder are then prepared for the seed, which, two days before it is sown, is steeped in water. In this moist condition, it is rubbed upon pack-threads, which are buried in the drills, or it is laid in them, after having been dried in the air. If the weather be very dry after the sowing, the seed-beds should be watered; and this must be done without delay, for the sprouting begins within twelve days after the seed has been deposited in the earth. There are, however, examples of a later developement, without any ill consequence. Three weeks would not be too late. To defend the seed-beds against night frosts, they should be lightly covered with brambles and twigs, which would also be serviceable for obviating the ill effects of an ardent sun. Lateral shoots are better taken off from the young plants, as they leave more vigor, and insure a greater concentration of the sap in the main stem. As much as it is necessary to attend, in the spring, to the watering and to the clearing of the weeds, care must be taken, towards the end of August, not to water too much on a rich soil, on account of the facility with which a second springing of the young plants might be promoted, and the difficulties they might encounter in ripening their wood, before the winter sets in. The seedlings, after having grown to the height of one foot, must not remain too close together, nor should lofty ones be permitted to overshadow a group of lower growth. Thinning and transplanting are the proper remedy against this inconvenience.

With transplanted plants, the course is nearly the same as with the young plants in their first beds; like them they must be covered either with straw mats, chopped straw, or dry leaves, and cleared of all weeds, and watered at proper times.

In the third year, the seedlings are fit for hedges. Plants destined to become full grown trees, are set out in rows two feet from each other. The branches ought to be shortened; the stem grows then quicker, straighter, and stronger. But they must not be lopped off indiscreetly, nor close to the stem, for numerous wounds might blight the tree.

'The best method to propagate the white mulberry trees,' says a writer from Louisiana, 'has been found to be from the seed. A large nursery is easily made; the plants can be taken up the second or third year, and transplanted at a distance of twenty to twenty-five feet apart. Should the paper mulberry (M. Papyrifera) be found to be as good a food for the silkworms, as the other varieties, I think it could be multiplied much easier, and more abundantly from the sprouts, which never fail growing in quantity round the trees; they grow faster, and their thick foliage is a proof, that they would afford more leaves in their relative proportions of size than any other kind.' *MS. Letters.*

The second method of rearing the mulberry is by roots. This process requires great care.

The propagation by layers, does not differ from the process followed with other plants, except that the mulberry, though elastic, requires great care to prevent their breaking in laying down the tender branches. They should be bent down when the sap begins to rise. The layers often take root within a year, and they can then be cut off from the parent tree, in the ensuing autumn or spring, and transplanted.

Cuttings are best procured by pruning two-year old branches from straight trees; and perpendicular shoots are preferable to horizontal ones, for they grow pretty much in their original direction. The proper length is from six to fifteen inches; they are put down for two thirds of their length into the mould, which is pressed close about them, and carefully watered, if the weather be dry.

To prevent slugs and snails from injuring the plants (and a large number might be destroyed by them in a single night), hot lime or ashes are recommended, and should be put upon the beds, when they are somewhat moistened by rain. Soot may be strewed around with good effect, but not upon them, on account of its acrid principle.

Tall trees seem less proper for the rearing of the silkworm, not only on account of the difficulty of removing their leaves without injuring the parts against which the ladders are rested, and the jeopardy connected with this task, but it seems admitted on all hands, that the leaves of trees that are annually pruned, produce better silk. 'The stripping of the leaves,' says Hazzi, 'should not begin before the disappearance of the dew, and ought to be concluded before the setting of the sun. The hand should move from below upwards, though it would be easier to strip them in the contrary direction.

We transcribe the following passage from Mr Rush's letter, in regard to the formation of a mulberry hedge.

'Choose grafted mulberry plants of one year old, and place them eighteen inches apart, in a furrow prepared some months before. To these may be added grafted plants of two years old, which have grown well, and which have been cut off to increase their vigor; but they must be separated from the others, to prevent irregularity in the hedge. Cut them at four or six inches from the ground, leaving two buds opposite each other; remove all the rest. In this way, the stalk has two vigorous branches the first year. In the following spring, cut one of these two branches on the same side, at about one foot from the ground, so that each plant has a short and a long one. Bend horizontally on the same side also, one after another, all the preserved branches, and fix them with willow-withs, so that they may form a line parallel to the earth, and leave untouched the entire branches. Experience has taught, that, if their extremities be cut, they grow slowly, and even die. At the commencement of the third year, the plants will have branches to form a hedge. Then cut them about two feet from the ground, but do not use the leaves. This plan has the following advantages;

'1. The mulberry plants being grafted, and well arranged, and those of the first year being separated from those of the second, the hedge will grow with force and regularity.

'2. The plants which have been cut down will push out near to the ground, and furnish numerous branches. When a plant dies, replace it by layers from an adjoining one; if a new plant be substituted, it rarely succeeds. The leaves from the layers must not be pulled during the three first years.' p. 42.

The mulberry leaf contains five substances; the solid or fibrous substance, the coloring matter, water, the saccharine substance, and the resinous substance. The most important element for the feeding of the silkworm, is the fourth; and on the proportions in which these divers elements are combined, depend the weight and nutritive capacity of the leaf, which are not in the same ratio, compared with the quantity of silk obtained from the worms that have been fed upon them. The white mulberry, when planted on elevated ground, in a light soil and not damp, excels in the quantity, strength, purity, and fineness of the produce. But in regard to the white mulberry, a distinction must yet be made of the several species; one produces red, another black, and two produce white berries. One has deeply indented leaves; the other, less indented, but longer. Delongchamp recommends a species which he calls 'Colombasse' and 'Colombassette,' the leaves of which are small, thin, and silky, and the rose mulberry, with larger leaves than those of the preceding species, and of a deeper green.*

Most of the writers on the subject agree, that this tree thrives in cold climates. It certainly prospers in Sweden and at Pekin, where the winter is severe. It flourishes in Russia; and that species which is designated by the name of Tartarian mulberry, in the Secretary's report, might easily, it is said in the same document, be reared in this country.

Lastly, according to Dandolo, the double-leaved mulberry seems the best for the culture of silk; 'the leaf is small, not very succulent, of a dark green color, shining, and contains little water; which may be easily ascertained by drying some of them; the tree produces them in great abundance.' But the wild tree has still an advantage over the grafted. According to experiments instituted by Count Dandolo, the former yields less of leaves; but seven and a half pounds of cocoons, proceeding from worms fed upon them, give fourteen ounces of fine silk, whilst the same weight of cocoons, the produce of worms fed upon the grafted trees, would yield two or three ounces less. Fourteen pounds and a half of the wild mulberry would be sufficient to produce one pound and a half of cocoons, whereas for the same quantity of silk-bags or cocoons, twenty pounds and three quarters of leaves of the grafted tree would be requisite. Diseases are also rarer among the worms in the one, than in the other case. However, the grafted tree gives a greater quantity of leaf; and it is probably on that account, that this method of improving is in great favor in Italy, and that even hedge mulberry trees are grafted. The several methods of doing this do not differ from those commonly followed, and especially in France, with the large chestnut. The document of Congress contains a brief recapitulation of them, with two wood cuts, which add to the distinctness of the text.

In regard to the quantity of leaf, the statements vary according to the species of trees, the different degrees of care that are bestowed upon their rearing, and many local circumstances. The accounts vary from forty to sixty pounds of silk, in one season, for one acre. According to Dandolo, twenty-one pounds of mulberry leaves give one pound and a half of cocoons. He obtained the same quantity of cocoons, in Dalmatia, from fifteen pounds of leaf. Barham, in his 'Essay upon the Silkworm' (London, 1719), says,

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* Mr William Prince, of Flushing (Long Island), has, it seems, a provision of the best varieties of the white mulberry imported from Europe; and Mr Dusar, of Philadelphia, has also received a supply of young trees from France.

> 'Having mentioned Mr Evelyn's computation, one mulberry tree feeding as many silkworms with its leaves, in one year, as made seven pounds of silk; according to that estimate, those two thousand trees, already planted in Chelsea Park, (which take up one third part of it) will make fourteen thousand pounds' weight of silk, to be commonly worth but twenty shillings a pound, those trees must make fourteen thousand pounds sterling per annum (which is but a small number of trees to what the company intends to plant). So that allowing the one half of fourteen thousand pounds per annum, nay, but a fourth part of that sum, and it will evidently appear, that the profit of this undertaking, if tolerably managed, will be the most considerable which was ever yet known in Great Britain.' p. 95.

This passage is curious, for a comparison of the prices, and as an illustration of the slowness, with which certain truths produce conviction; for nearly a century elapsed before the subject was taken up in England, in good earnest.

In the official and unpublished report from Louisiana, which we have already once quoted, it is observed,

> 'I could not say what quantity of raw silk might be produced, on one acre, in this state. I have no doubt, however, that the following calculation could be safely depended upon. It is looked upon as a fair average in Piedmont, Lombardy, and Tuscany (in the kingdom of Naples, the produce is greater), to wit; one acre will contain about one hundred trees, which will yield at least two thousand pounds of leaves; these will be amply sufficient to feed the worms hatched from two ounces of seed, or about eighty thousand worms. Two thousand five hundred worms will, taking all accidents into consideration, average, at least, one pound of silk. Thus, one acre is calculated there to a net revenue of from thirty to thirty-two pounds of silk.'

The mulberry tree was first introduced upon the American continent, for the purpose of the culture of silk, in the Colony of Virginia. James the First, having found it difficult to resist the clamors of the British merchants, who apprehended from this branch of industry, if introduced and extended in England, great danger to the commerce of the kingdom, (with as much good sense and foresight as the city of London displayed, when she petitioned Parliament against the use of hops and

Newcastle coal,) endeavored to introduce it into Virginia; and having himself composed a book of instructions on the subject, the royal patron of the culture of silk, caused mulberry trees and silkworms' eggs to be sent to the colony, and directed the Earl of Southampton to urge the cultivation of silk in preference to that of tobacco. The earl recommended, also, the plantation of vines, perhaps as a substitute for the narcotic weed, which was so offensive to his sovereign. In 1623, the colonial Assembly gave some directions to that effect; and thirty years after, it was further enacted, that every planter who should not have reared, at least, ten mulberry trees for every hundred acres of land in his possession, should be fined in ten pounds of tobacco. Premiums, in the form of the same produce, (which was indeed, at that early time, a substitute for money in Virginia, as much as sewing silk is, at present, a part of the circulating medium in one of the counties of Connecticut,) were offered for the prosecution of the silk trade, and the exportation of silk. Five thousand pounds of tobacco were promised to any one who should produce one thousand pounds of wound silk, in one year. In 1666, all statutory provisions of a compulsory or remunerative nature were repealed, because the business was in so thriving a condition, as no longer to require protection. A new attempt was however made, three years later, to encourage it further by bounties. But, finally, in 1669, the government ceased altogether to interfere in this business. In 1664, a member of the legislature, Major Walker, stated that he had seventy thousand mulberry trees upon his estate. We regret that we are unable to represent the actual state of this branch of rural economy in Virginia; Mr Rush's report merely mentions that the white species abounds, at present, in the eastern part of the state.

In Georgia, at the earliest period of its settlement, lands were granted, under the condition of planting one hundred white mulberry trees on every ten acres, when cleared; and the trustees of the colony transmitted from England trees as well as seed and silkworms' eggs. The first parcel of silk which was sent to the metropolis, weighed eight pounds. The public seal of the colony represented silk worms in their various ages; and had for its inscription, *Non sibi, sed aliis.* Mr Rush's Report contains the following passage from a manuscript register of the trustees of the colony, under date of 1736, a year after the first silk was sent from Savannah to England; 'The raw silk from Georgia, *organzined* by Sir Thomas Lombe, was made into a piece of silk, and presented to the Queen.' From another entry in the same manuscript it appears, that in 1738 a rich brocade was made, and the silk from Georgia was dyed, which cost twenty-six pounds. The value of silk exported, from the year 1750 to 1754, was rated at eight thousand eight hundred and eighty dollars; and from 1755 to 1772, the quantity amounted to eight thousand eight hundred and twenty-nine pounds.* The last parcel, brought for sale to Savannah, it is said in Rush's Report, was in the year 1790; when upwards of two hundred weight was purchased at eighteen dollars and five cents, and twenty-six dollars and five cents, per pound.

We copy from the very instructive letter from Darien, which we have already quoted, the following historical remarks, and sound economical reflections.

'We must be surprised and astonished, at the rapid increase this culture had made, considering the very few hands, who were engaged in it; for in the year '52, the proprietors had relinquished their claim to the crown. With this change of government a change of views and objects took place. The colony was thrown open to emigrants from other states, who, removing into the country with their negroes, brought with them the objects and the habits of cultivation, to which they had been accustomed. Rice and indigo were introduced by these emigrants; and being objects upon which masses of population might be brought to bear at once, and upon which the year gave an immediate return, the culture of silk was literally smothered by these articles. We have been, unfortunately, too prone to these changes in cultivation. Indigo has given place, since the war of the Revolution, to cotton; yet indigo would, at this time, give twice the profit that cotton does; and will, no doubt, be returned to. As far as I can learn, the annual product continued in Georgia at about ten thousand pounds up to the revolutionary war. In the year '75, I am informed that the single house of Habersham and Harris exported to London eight thousand pounds of silk. There are still a few hundred weight produced annually by the remains of the families who originally cultivated silk.' *MS. Letter.*

In South Carolina, the culture of silk was taken up by ladies; and Dr Ramsay very justly did not think it beneath the dignity of history to mention, that Mrs Pinckney, who had introduced, ten years before, the indigo plant into that colony, took with her to England a quantity of excellent silk, the produce of her own cultivation, and sufficient to make three complete dresses, one of which she presented to the princess dowager of Wales, and another to Lord Chesterfield; the third dress was in the possession of her daughter, Mrs Horry, as late as 1809. The South Carolina silk is inferior to that of Italy, neither in strength, nor in beauty; but the quantity of raw silk exported in the space of six years, did not exceed two hundred and fifty-one pounds.

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* Mr Charles Harris's letter to the Secretary of the Treasury.

In Pennsylvania and New Jersey, the cultivation of silk began in 1771. Dr Franklin gave it a strong impulse by a letter which he addressed on the subject to Dr Cadwallader Evans, from London, January 15, 1770. The Philosophical Society, to whom he sent the work of the Abbé Sauvage, a summary of which has been published by Mr Odell of Burlington, resolved to petition the legislature for the encouragement of this new branch of industry, and proposed to raise a fund by subscription, for the purchase of cocoons and a *filature.* Eight hundred and seventy-five pounds were obtained in the first year, among the citizens, and this money was well employed. Unfortunately, the war of the Revolution put a stop to the scheme. But within the last three years, a new spirit seems to have been awakened in its favor; and nothing but a want of a market for cocoons obstructs its rapid progress.

Mr Nathaniel Aspinwall, who, about the year 1790, applied himself with a laudable zeal to the revival of the culture of silk in Pennsylvania, New Jersey, and New York, had already introduced it into Connecticut, in or about 1760. To Mansfield, in the county of Windham, he sent from his establishment in Long Island, white mulberry trees and silkworms' eggs; and in New Haven he opened a large nursery of the trees. Through his exertions, aided by those of President Stiles, he induced the legislature of Connecticut to grant a premium for every hundred shrubs or saplings, which should be planted and preserved in a thrifty condition, for a certain number of years, and for all raw silk produced within the state. 'At present,' (says Mr. Z. Storrs, postmaster at Mansfield, in a letter to governor Wolcott,) 'three fourths of the families in Mansfield are engaged in raising silk; and make annually from five to ten, twenty, and fifty pounds in a season. It is believed that there are annually made, in Mansfield and the vicinity, from three to four tons.'

'Sewing silk,' observes governor Wolcott, 'is an article of general demand throughout the country; that which is imported is formed from imperfect materials, while that made at Mansfield, being from the best, was found to be lighter, stronger, and smoother, than its foreign competitor, and the whole quantity being less than the market demanded, it was readily received by the country dealers, and itinerant traders. Skeins of sewing silk, though separately of small value, are, in bunches, a species of currency equal, at the market rates, to gold and silver coins, and are exchangeable for any articles which are required in the district. The produce of silk thread or twist is said to be, at the present time (November 1826), from twenty-five to four or five hundred dollars, in different families; *and the farmers of this district have been hitherto, in a great measure, protected from the desolating consequences of the paper money issued from banks.* This happy result the people owe chiefly to the industrious habits of the women of Mansfield and its vicinity.' *MS.*

According to Mr Storrs, the price for young trees, in Mansfield, is from four to six dollars the hundred, and they can usually be obtained in plenty. The common estimate is, that four thousand worms will yield one pound of silk, and a full grown mulberry tree will give leaves, in one season, sufficient to feed six thousand. An acre of full grown trees, under the best cultivation, produces at least sixty pounds of the raw silk in one season.

No details are given in the congressional documents, about the actual state of the cultivation of silk and mulberry trees in the other states; but it seems that in Illinois, Ohio, Kentucky, New York, and the New-England States, Maine excepted, this branch of industry is not entirely neglected.

In regard to Louisiana, it appears from the unpublished memorandum of an intelligent citizen of that state, that

'The upper section, beginning as far south as Baton Rouge, on the eastern side of the Mississippi, and as far south on the west side as the highlands extend, is well adapted to the rearing of the silkworm. Cotton being likely to become a crop which will hardly pay for the labor of its culture, some other profitable employment is, or, at least, may happen to be a welcome substitute, and the culture of silk may become a preëminent one.'

Lettuce, currant, grape, and elm leaves are esteemed substitutes, in case of a great dearth, for the most natural food of the silkworm; but the silk they produce will be less and inferior. The hornbeam has also been tried in Piedmont as a succedaneum.

Having now disposed of the mulberry tree, we proceed to the worms which feed upon its leaves, and which are, as it were, its inseparable companions, at least in the eyes of manufacturers and economists.

Insects are strikingly distinguished from other animals, by a succession of changes in their organization and forms, and by their incapacity of propagating before their last metamorphosis, which, in most of them, takes place shortly before their death. Each of these transformations is designated by so many terms, that it may not be useless to observe to the reader, who has not previously paid attention to the subject, that *larva*, *caterpillar*, *grub*, *maggot*, or *worm*, is the first state of the insect, on issuing from the egg ; that *pupa*, *aurelia*, *chrysalis*, or *nympha*, are the names, by which the second metamorphosis is designated ; and that the last stage, when the insect assumes the appearance of a butterfly, is called the *perfect state.*

Independent of the three abovementioned changes, another is observable in the outer skin of these insects. The epidermis is often different in color from the skin which supplies its place, and the worm assumes thereby a new aspect. In its first stage, as a larva, the silkworm has a hairy skin, which, in the following moulting, on the contrary, is smooth, and its color too is altered.

In the able report of Mr Rush, the description of the insect is remarkably ample, especially in regard to the sexes of the silk caterpillar. The male and the female are obscurely white and hairy. But the antennæ are unequally spaced in the male ; and in the female they are not so short, are less provided with bristles, and lie on her sides when she reposes. The males are also distinguished by two brown bands, more clearly marked on the upper wings. The female is larger than the male.

One of the most remarkable features in the organization of this wonderful insect, is the organ of vision. Their eyes, though immoveable, embrace, by a peculiar construction, all surrounding objects, and as Reaumur conjectures, serve also as a file to cut the threads of the cocoon, when the insect strives to escape from it. They are protuberant ; and their surfaces consist of a multitude of hexagonal lenses, placed with the greatest regularity. When the eye is separated, and made clear, (we quote from Mr Rush's report) these hexagons are as transparent as crystal. Leewenhoeck having properly prepared, and fitted an eye to a microscope, could see through it clearly; but the largest objects viewed, were diminished to an incredibly small size. The steeple of the church in Delft, which is three hundred feet high, appeared, at the distance of seven hundred and fifty feet, no larger than the point of a needle, seen by the naked eye. Cuvier uses the expression *composite eyes*, to denote the multiplicity of lenses.

The body of the silk caterpillar consists of twelve rings, nine of which are provided, on each side, with breathing holes. These eighteen *spiracula* communicate with two air vessels, running parallel the whole length of the body, and performing the functions of lungs. The insect has sixteen feet, under the rings, eight on each side; and consequently not all the articulations or rings are endowed with feet. Each foot has a considerable number of hooks and claws; Malpighi counted forty; and those of the six first feet are curved to enable the insect to fasten itself. The mouth has two parallel jaws, with teeth which move horizontally.

But the most important part of this organization is the silk-hole near the lower lip. It terminates in a little *papilla*, that gives issue to the silk-juice, which, by the contact of the air, hardens into filaments. Two parallel tubes of equal size, of one foot in length, are the vessels in which the silk is formed. When the caterpillar is about spinning its silky covering (the cocoon), these vessels become filled with a glutinous matter, the color of which determines that of the silk, which again depends on the quality of the leaves. But it is not always the same throughout each of the two vessels; being, in the upper part, sometimes of a more yellow color than in the lower.

The silk caterpillar changes its skin four times, in consequence of its growth. These are great crises in its existence. The little animal suffers, languishes, and ceases to eat. It labors, however, industriously to overcome the trials which nature has imposed upon it. All its efforts tend to throw off its skin. At last, a slit becomes visible in its back, and the new skin may be seen through it. Soon the head appears through the opening, and at length the whole body is disengaged. The cast-off skin remains entire, like a transparent mould.

The intervals, at which the four moultings follow each other, depend on the climate or temperature, and on the method and the quality of the feeding. In this country, the first moulting begins on the fourth or fifth day after the worm is hatched.

The appetite of the insect increases with its age; and is at its maximum after the fourth moulting. It has then attained its greatest size; and when the silky substance is elaborated in the reservoirs, the caterpillar ceases to eat, and soon diminishes again in size and weight. This fills a period of nine or ten days of its existence, beginning from the fourth casting-off of the skin; and now the insect begins to spin its silky sepulchre. But, in this operation, it proceeds with the greatest caution. It looks carefully for a spot upon which it can throw the first threads; and when it has made the choice, it glues one end of the threads, and by successive marches to and fro, but in various directions, it forms a netting, slight and loosely spun. After having finished this outward covering, it makes in the interior a succession of layers, to thicken thereby its spherical walls; and within three days, or three days and a half, the cocoon is finished. Were the cocoon wound circularly, and not zigzag, the unravelling, in the winding-off of the cocoon, would be regular; but probably the bag would be less strong.

In nearly the same space of time as is required for the formation of the cocoon, the caterpillar undergoes its second great transformation, and becomes a chrysalis. It first throws off its skin, with the head and jaws attached to it, and hardens on its exterior, though the interior remains soft. Its nourishment is already in its stomach, and consists of a yellowish mucus; but gradually the rudiments of the butterfly unfold themselves, the wings, the horns, and the legs becoming solid; a slight swelling of the body produces a rupture in the membrane that covers it, and by repeated efforts the butterfly is at length free; but, as yet, only within the cocoon. We have already mentioned Reaumur's remark, in regard to the help which the insect finds in the structure of its eyes, to file the cocoon. Other observers believe that it is assisted in this operation by a liquid which it discharges, and which dissolves the gum that holds the silk fibres together. In Mr Swayer's opinion, the moistening and the efforts of the head are both required, perhaps, to accomplish the task. Some believe that the extremity of the cocoon, through which the butterfly makes its escape, is always thinner than the rest.

The time requisite for the several changes, depends greatly on the temperature in which the eggs have been kept during the winter. If the heat of the apartment has been well regulated, the first moulting takes place on the fourth or fifth day after the hatching; the second begins on the eighth day; the third takes up the thirteenth and fourteenth days; and the last change takes place on the twenty-second and twenty-third days. The fifth age lasts ten days, at the end of which the caterpillars have reached their ultimate growth, being three inches in length, and are prepared to spin their cocoons. Thus thirty-two days is the time that intervenes between the hatching, and the beginning of the cocoon.

Temperature, again, is one of the most determining causes of the continuance of the chrysalis. If the cocoons are kept in the temperature of sixty-six degrees of Fahrenheit, the butterfly makes its appearance after fifteen days; and it can be retarded to a month, as the Abbé Sauvage had occasion to ascertain, by depositing some cocoons in a vault.

The caterpillar's skin in a crumpled state, with the head, and jaws, and shell of the chrysalis, remains in the cocoon. Having gained their liberty, the moths of neither sex attempt to fly. The last great instinct of animated nature guides them to each other, and his destiny thus fulfilled, the male dies. The female crawls about, lays from two hundred to four hundred and fifty minute eggs, and dies also. The eggs, when first laid, are of a pale yellow, but in the course of eight or ten days they assume a reddish gray hue, and some time after that, a slate color. The unimpregnated and consequently sterile eggs remain yellow, and are depressed on their surface.

We must, from want of space, refer the reader to the document mentioned at the head of this article, for the enumeration and description of several varieties of silkworms. It will be sufficient to mention here, that there are, according to Dandolo's personal observation, first, small silkworms of three moultings; secondly, large silkworms of four moultings; thirdly, worms that produce exclusively white silk; and fourthly, silkworms of eight crops. This latter species is, perhaps, the same with that of which Arthur Young makes mention, (*Annals of Agriculture*, vol. xxiii, p. 235.)

In 1815, eggs were procured from Bengal, which bred three times a year. In a letter from Prairie Haute, in St Charles county, Missouri, it is mentioned that several crops were obtained, without artificial means, from eggs that had been procured from Philadelphia. At Bethlehem, in Pennsylvania, two crops were raised.

Mr Zalmon Storrs mentions, in his letter to Governor Wolcott, that there are at least three varieties of silkworms in Connecticut. The first is the dark brown or flask worm, 'which,' observes he, 'is considered the best, the largest, and makes the most silk. The second a pale white worm, nearly or quite the size of the first, but which does not live so long, or make as much silk; and the third is a smaller, pale white worm, which passes through its transmigration twice in one season, producing two crops of silk; but as it produces less silk than either of the others at one crop, it is not much used, though the silk possesses one property, which that of the others does not; namely, when spun and used in its native state, it retains its clear whiteness, and does not turn yellow by washing and exposure to sun and air.' *MS. Letter.*

The silkworms are reared in the open air or in laboratories. The first method is followed in some parts of China; and as the mean temperature of that country is not very high, it has been thought that there would not be any danger in adopting it in some parts of Europe. The Austrian government at one time directed the experiment to be tried by some of its regiments on the Illyrian and Wallachian frontiers. Mr Hazzi furnishes, *in extenso*, the reports of the commanding officers, and they are not of a nature to encourage any farther trial. Count Dandolo constructed, for his own use, a laboratory, which is now imitated in several parts of Italy. It is minutely described in his work *Dell' Arte di governare i Bachi da Seta*, and the most important details are transcribed or extracted in the congressional document. The principal object to be attended to in the erecting of such a building is, to construct it in such a manner, as to make it possible to regulate the degrees of light and air to be admitted into it, so as to correspond to the variable necessities of the worms. A free circulation of air is, however, the most indispensable condition of any room, or building, in which the business is pursued, on a great or a small scale. Considering the climate of this country, a cool and shady situation would be the principal point to be aimed at. An apparatus, invented by the Rev. Mr Swayne, offers this, among other advantages, that it requires a very moderate space, and that it can easily be kept clean, a circumstance essential to the health and preservation of the worms. Mr Rush's report contains a wood cut of this apparatus.

When the mulberry leaves are about to appear, the eggs are washed either with the cloth upon which they lie, or after having been carefully scraped off. They are then dried, and as the weather is not at that season warm enough, they must be deposited either in a hot-house, or in a room perfectly dry, the temperature of which can be regulated by means of a thermometer. The most indispensable implements and articles of furniture are a stove, several boxes of thin boards or thick pasteboard, some wicker trays or tables intended to support the boxes, and a few portable ones for transporting the young worms from one place to another. The wicker hurdles must be far enough apart to prevent the insects from wandering from bed to bed. The temperature, during the first two days, ought to be kept up to sixty-four degrees of Fahrenheit, either by artificial heat or by creating a draught to cool the internal air, according to the weather. On each of the following days, till the ninth, the temperature must be increased by two degrees; and on the three following days, it should not exceed eighty-one degrees.

The worms are formed when the eggs begin to whiten. Papers pierced with holes, proportioned to the age of the insect, are then extended upon them, with small twigs of mulberry. Healthy worms, on their first apperance, are of a dark or chestnut color, and never red or black. As their whole existence depends upon the state of forwardness of the tree upon which they feed, and as a sudden change in the weather retards sometimes the shooting of the leaves, the hatching must be regulated accordingly; and the mode of retarding it, is to diminish the heat of the laboratory. Independent of the temperature, a great deal also depends upon the quality of the eggs. The best hatching takes place between the first and third days after the eggs have been laid in the boxes. It is very essential that the worms to be reared come forth on the same day; and those of the first and after the third day are equally useless, and ought to be cast away, since the difference of their growth would render it impossible to attend equally to their necessities. According to Count Dandolo, thirty-seven thousand four hundred and forty eggs weigh an ounce; and the worms proceeding from them require, until their first moulting, a space of about seven feet square; from that time till the second moulting, double that extent; till the third, about five times the first space; and till the fourth, eighty-two feet square. But when there is but a single room for the breeding, a greater attention must be paid to the temperature.

The worms are kept on wider trays, lined with paper, turning upwards at the edges, to prevent their falling out. The temperature ought to be kept at seventy-five degrees, the insects requiring less heat upon growing older. It is highly important however, to shelter them against sudden changes, and against transitions from moderate to violent heat.

In the breeding of no animal, is the exact quantity of food with which it must be supplied, of so great importance as in the rearing of the silkworm. Sanctorius, who passed a portion of his life on a pair of scales to ascertain the effects of perspiration upon the human body, cannot have managed his experiments with greater care than is necessary in the distribution of the mulberry leaves to the newly hatched insects. The silkworms proceeding from an ounce of eggs, consume, in their first age, seven pounds of leaves; in the second, twenty-one pounds; in the third, sixty-nine pounds; in the fourth, two hundred and ten pounds, and in the fifth, one thousand two hundred and eighty-one pounds (French weight). The leaves must be chopped very small during the first period, and gradually less in the three following. At each moulting, the worms eat little for a short time; they become afterwards very voracious, and at last they cease to eat. The quantity of cocoons depends so much on the feeding, that the worms of one ounce of eggs, to produce one hundred and ten or twenty pounds of cocoons, require about one thousand six hundred and fifty pounds of leaf; and when only one thousand and fifty pounds of food have been expended, the same weight of eggs will give only from fifty-five to sixty pounds of cocoons. It is not indifferent whether the same quantity of cocoons proceeds from one or more ounces of eggs, for the quality is, in the one case, always better than in the other.

The following comparative results are mentioned in the document of Congress.

'If one ounce of eggs shall have produced, by the means stated, one hundred and twenty pounds of cocoons, they will be fine; three hundred and sixty, at most, will produce a pound and a half; and eleven or twelve ounces, at most, of these cocoons, will yield an ounce of exquisite, fine silk. When only fifty or sixty pounds of cocoons come from one ounce of eggs, it may generally be presumed, that they are of an inferior quality to the above, and it will require four hundred, at least, to make one pound and a half; and above thirteen ounces of these cocoons, instead of eleven or twelve ounces, to form one ounce of silk. Moreover, when the worms have not been properly managed, there is no certainty, as to the quantity of the cocoons that will be gathered; and it happens continually, that the same cultivator will, from the same quantity of eggs, and the same quality of the leaves, obtain, at one time, a number of cocoons, at another time few, and sometimes none.' p. 64.

It would be impossible for us to go into any further detail of the rearing of the silkworm. Nothing but a general glance can be given, in the few pages that are allotted to us for treating of a subject so extensive, in which repetitions are unavoidable, and which does not admit of conciseness. Most of the writers on this subject, have, independently of a minute exposition of the daily proceedings in the feeding and treatment of the worm, recapitulated their directions in tables, in which are indicated, in the fewest words that can be employed, the task of each day, though the several ages of the insects; the quantity of food that must be administered; the temperature and the space which the worms require; and the care which must be taken for their cleanliness and the preservation of their health. Such a table may be found in the report of Mr Rush, borrowed from M. Bonafon's Treatise 'on the rearing of silkworms.' (Paris, 1824.) We regret that our limits do not permit us to lay it before the reader.

We take it now for granted, that the worms have attained their perfect maturity, though many dangers have beset their existence, and a host of enemies,—fowls, mice, rats, weasels, ants, and spiders, may have lain in wait for them, and notwithstanding the various diseases to which they are liable. We suppose that they have already a deeper yellow color, that their rings have a more gold-like hue, and that their muzzle has become of a brighter red than before, which are the signs that they are near the close of their fifth age. The fumigations which must also have taken place during the former ages, should now be repeated twice a day, the air frequently renewed, and the attention to cleanliness redoubled. Generally on the last day of the fifth age they cease to eat, and move their heads as in search of something. They become transparent like ripe, yellow plums, and seek a change of place; their skins become wrinkled, and their bodies soften.

Bundles of twigs, which must be ready and arranged in bunches, are then put above the wicker trays, so as to touch the lower part of them, and bent in the form of an arch, to enable the worms to climb up without falling. On the first day they often need some assistance in that migration, and much care.

When the worms begin to spin their cocoons, it is very essential that no noise should disturb them in their labor, otherwise they would break their thread, and the cocoon would, consequently, be less perfect. Though the formation of the cocoons requires only three days, or three and a half, it is, nevertheless, thought prudent not to take them from the hurdles before the eighth or ninth day after the worms' first rising. They are then laid in baskets, and the floss, in which they have been formed, is taken off. A selection is made for future breeding, whilst the rest are destined for the reel. For the former purpose, two ounces may be saved out of one pound and a half of male and female cocoons. There are, besides, double cocoons, which, according to Sauvage, invariably produce a moth of each sex, and, according to Mr Nysten, contain moths of both sexes in unequal proportion. The seed cocoons are laid on tables, in layers, disposed in such manner as to be accessible to the air ; the temperature of which must not exceed seventy-three degrees. In this state of the atmosphere of the laboratory, they lose in ten days seven and a half per cent. by the dying of the chrysalis alone.

We must omit saying anything in regard to the last period of the silkworms in the state of moths, their coming forth, the laying of the eggs, and the means by which these may be preserved. It will be sufficient to mention, that 'fourteen ounces of cocoons produce, on an average, an ounce of eggs, which supposes a hundred pair of moths.' (*Doc.* p. 105). Eight pounds of cocoons, of the first quality, yield from sixteen to eighteen and a half ounces of silk. Fifty-five pounds of the second quality produce one hundred and nine ounces of raw silk. In Languedoc, one quintal of cocoons (104 lbs. Amer.) yields from nine to ten pounds of spun silk ; and the produce of one ounce of eggs varies between five and ten pounds of silk. (*Trans. Soc. Arts.* London. vol. XLIII.)

Before the cocoons can be reeled, the floss or loose silk which covers the outside, must be stripped off; the white ones must be separated from the yellow; the good from the useless (and there are nine different qualities in regard to the silk they yield.) The sorted cocoons are thrown into hot water, the temperature of which must be regulated according to the quality of the food upon which the caterpillar has been fed, and the firmness of the cocoons. This process serves to kill the moths; and, therefore, if the cocoons can be reeled off, as soon as they are formed, and before the moths are evolved, it becomes unnecessary, and the reeling is then easier, and the silk of a superior quality. But when it has become indispensable to kill the chrysalides, it may be done, not only by steam, but also by the heat of an oven. Both methods are described and discussed in the report. In Italy, the cocoons are, for the same purpose, exposed to the ardent heat of the sun, during three days. Each cocoon consists of a single thread, the length of which varies from nine hundred to one thousand and two hundred feet.

The reeling is not equally easy with all sorts of cocoons, a vast deal depending on their quality and the temperature of the water employed for the soaking. Mr Rush's report is accompanied with a plate representing an apparatus, which it would be necessary to copy in order to give the slightest idea of the manner of using it; and, in the document, not only is this done with great accuracy, but the explanation hardly admits of an abbreviation. Those who have no idea of the thousand little attentions which this business requires, will wonder on reading the fifteenth chapter of this copious and elaborate performance. It contains, also, much valuable information about various engines, reels, and looms, the most recent improvements in that branch of machinery. We cannot but greatly applaud the care which has been bestowed in annexing a sufficient number of plates for the better understanding of the text.

We have now gone as rapidly and directly as possible through the two stages of the culture of the silk—the raising of the mulberry tree, and the breeding of the silkworm; and we do not enter into the consideration of the fabrication of silk stuffs, for which the country is perhaps not yet prepared. It will be, at first, sufficiently beneficial to possess raw, carded, and spun silk in sufficient quantity for sending considerable supplies abroad. We find in a statement of the raw silk imported into England, from all parts of the world, that in 1814, it amounted to one million, six hundred and thirty-four thousand, five hundred and one pounds; and in 1824, to three millions, three hundred and eighty two thousand, three hundred and fifty-seven.* Italy, which is not better situated in regard to the culture of silk than a large portion of the United States, furnishes to the English fabrics about eight hundred thousand pounds' weight. The Bengal silk is complained of by the British manufacturers, on account of its defective preparation; by bestowing more care on his produce, the American cultivator could have in England the advantage over the British East Indies. It is a fact well worthy of notice, and the accuracy of which seems warranted by its having been brought before a Committee of both Houses of Parliament, that the labor in preparing new silk affords much more employment to the country producing it, than any other raw material.† It appears from an official document, that the value of the imports of raw silk into France, during the year 1824, amounted to thirty-seven million, one hundred and forty-nine thousand, nine hundred and sixty francs.‡

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* The official values of these imports are £703,009 and £1,464,994.

† According to Arthur Young, the province of Valencia produced, in 1787, two million pounds of silk, the value of which he rates at two million pounds sterling; a sum equal in amount, at that epoch, to all the other productions of that portion of Spain.

‡

Cocoons,		39,255
Soies grèges,	Douppoins	78,975
	Autres de toute sorte	6,504,960
" moulinées,	Douppoins	72,710
	Autres de toute sorte	25,658,640
" teintes,		46,665
" bourre	écrue	1,241,172
	filée (fleuret écru)	3,504,475
	filée (fleuret teint)	108

Tableau des Douanes Royales de France.